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Content Analysis of Jordanian Elementary Textbooks during 1970–2013 as Case Study

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Abstract

This study aims to determine types of mathematic disciplines (in term of topics) in Jordanian Elementary textbooks. This study evaluates mathematics text books especially in the period between 1970 and 2013 and identifies types and quantities of mathematics. To examine the relative quantity of mathematics, branches of mathematics, presentation means, and methods, books were analyzed using content analysis protocols. As a result, this work has shown a significant increase in mathematics enhancement in terms of quality and quantity in Jordanian elementary textbook. Such enhancement is relevant to the advantage of new technology based on mathematical algorithms. In addition, this research has pointed out the growth in geometry while numbers of mathematics show a decline in return as of 2013. Based on this study the recommendation concluded is to further develop textbooks in order to meet NCTM requirements.

Keywords: content analysis, curricula, evaluation, mathematics, textbook

1. Introduction

Textbooks (also known as students' books) play a major role in Jordanian schools. For instance, main curricula, courses outline, resources, methods of teaching and studying were all developed based on textbooks. However, students' books have always suffered from lack of clarity in many aspects such as; story illustrations, real life examples, articles pertained to various topics as sociology, science, art, religion, and anthropology. The early 1970s basic mathematics education in Jordan can be traced back in the student's books. That is, mathematics was taught as a separate subject, and it was introduced to children through their textbooks only. Therefore; the analysis of mathematics in early stage students' books was an important issue to understand as a foundation in elementary education. In 1987, a significant national conference was held in order to start the first comprehensive educational reform in Jordan. The educational reform's components were; training programs, curriculum, research, an environmental classroom etc., which were supposed to enhance students' skills (Ministry of Education [MoE], 1987). Thus, curricula of school subjects' were to be designed to focus on the development of students' thinking and solving problems.

"A new theme termed "Educational reform for the knowledge economy" is now being executed, marking a new phase in educational reform that has begun as early as 1988. This development aims to change the educational system at the onset of childhood in both basic and secondary stages to graduates equipping them with highly needed skills of knowledge. This change entails that students show basic key skills and core competencies in addition to enhancing essential content" (Innab & El-Sheikh, 2006).

General objectives of teaching mathematics in Jordan are based on the philosophy of Jordanian society, and these goals aim to enable students to acquire knowledge, skills, values and attitudes to help them in the individual and collective development. These approaches are characterized as being commensurate with the local environment; represent the reality of the student through putting him in life situations, and helping student to be able to solve the problems and issues related to the needs of everyday life.

Mathematics curriculum in Jordan is consistent with the principles and standards of the National Council of Teachers of Mathematics in America (NCTM). Curriculum in general and mathematics curricula in particular have undergone continuously to the development process in the previous years, the last development happened in the beginning of the academic year 2014/2015 through developing mathematics curriculum for the first three

classes of the basic educational level.

All public and private schools in Jordan apply this curriculum issued by the Ministry of Education, and some private schools rely on additional curricula in mathematics to support the educational level, and to meet the needs of students, which vary based on the level of these students. There is also in Jordan some international schools with a special international program contains materials in math (MoE, 2010), for example: International Baccalaureate, the International General Certificate of Secondary Education (IGCSE), General Certificate of education (GCE), and the Scholastic Aptitude Test (SAT).

The Ministry of Education in Jordan has agreed to the equation of these certificates to the Jordanian public high school (tawjihi) and adopted this in Jordanian universities for acceptance. Moreover, these certificates qualify students to study outside Jordan in certain disciplines and certain countries.

The objective of this study is to describe and analyze the history of elementary mathematics education. Such analysis will be approached by analyzing students' books that have been designed from 1970 till 2103. Content analysis is used to examine students' books for the related quantity of mathematics, types of mathematics and methods of presentation.

1.1 Background of the Study

1.1.1 Textbook as the Curriculum

Alsir (1994) and Alalem (1994) noted that education in Jordan depends on textbooks, while in modern educational systems, Keith (1991) asserts that "textbooks are frequently the student's major source of information on a particular subject taught in school, and may even constitute the only exposure the student receives on a given topic" (p. 43). Textbooks also have the main role in defining school subjects as students experience them, Valverde, Bianchi, Wolfe, Schmidt, and Houang (2002) believe that they represent school disciplines to students. As asserted by Chiappetta and Fillman (2007) textbooks on mathematics are to be utilized as the major organizer of subject matter that students are supposed to master. They are also supposed to supply detailed demonstrations of topics on all levels.

Textbooks are extremely important in the educational systems as teaching material and source of instruction methods. Instruction as adopted by modern society is affirmed by Harris (1980) as the most direct effective approach of initiating the involvement of individuals in real engagement in the activity of their community. According to Alsir (1994), the importance of textbooks has been partially related to inexperienced teachers in classrooms. Teachers rely heavily on well-known textbooks to have reasonable preparation prior to their classes. In the same manner, Nietz (1961) has pointed out that the main representative course of study is curricula. On a parallel level, Williams (1982) stated that knowing the content of previous textbooks is vital for understanding the past and present status of education.

Based on the previous discussions, and with reference to scholars such as Rillero (2010); Calhoun and Rubba (1993); Eltinge and Roberts (1993); Keith (1991) and Tyson-Bernstein and Woodward (1991), it can be concluded that the core stone of having a better vision and a comprehensive understanding of modern education is to have deep knowledge about the current textbooks.

Most authorities in Jordan agreed that old textbooks used in 1970 in any public school have largely constituted the current school courses of study. As a result, an analysis of old Jordanian school textbooks reflects the evolution of methods of teaching and learning in addition to the Jordanian school curriculum (Shirly, 1984).

1.1.2 Student's Book

Exactly like what happened to textbooks; public schools are developed into the present elementary schools. Lessons that are common as schools' most used textbooks constitute mathematics textbooks. Soltow and Stevens (1981) assert that past instruction in primary schools focused on the skills reading, spelling, writing and calculating. It was also through reading that most of teaching in these four areas was carried out through age six and up. The primary purpose of the basic stage in Jordanian schools is to teach student how to read and write letters and numbers (Abu Ali, 1989). Mathematics' book is the most important textbook aiming to educate students in a simple way by focusing on numbers at the beginning, and mathematical operations with numbers in advanced stages. To fulfill the aforementioned objectives, the lesson was presented in one or two pages in length. A diverse range of important topics including addition, subtraction, multiplication and division were presented. What was intended is to aid students learning.

1.1.3 The Beginning of Mathematics Education

The review of early schooling is always directed by concentrating on calculating, reading and writing. There

were mathematics textbooks taught as a separate subject (Abu-Zeineh, 2010). Students learned about mathematics through content area selections in student's book of mathematics. Thus, the mathematics textbook was the origin of Jordanian basic mathematics education. The mathematics lessons in the student's book of the first years of education in school were students' first exposure to school mathematics. Most students did not go to school before first grade. Prior to 1970, only 1.2 % of the population between 7 and 9 years of age enrolled in schools (MoE, 1987). Thus, for many Jordanian schoolchildren, the mathematics selections in the primary student's book are almost the only formal mathematics education encountered. Mathematics in these textbooks was the student s' first mathematical experience at school.

1.1.4 Significance of the Study

The importance of this study points out the importance of mathematics textbooks. Investigating the importance of mathematics content in textbooks and focusing on modern usage of the textbooks to have a better understanding of the educational system. Such understanding can identify local and global developments in Jordanian textbooks used with relation to that specific period of them from 1970-2013. To the knowledge of the researcher, none has been conducted.

1.1.5 Limitations of the Study

The content analysis of Jordanian elementary textbooks is limited by the students' books of the first three classes of the basic educational level.

2. Method

In order to investigate the past trends and get a deeper understanding of present trends, the historical methods of inquiry were used. Within this context of inquiry, content analysis protocols were employed to examine mathematics in 1970 students' books.

Berelson (1952, p.74) described content analysis as "a research technique for the objective, systematic, and quantitative description of manifest content of communications". This technique is used to find out the percentage of mathematics in the textbooks, In terms of page and lesson. The technique also classifies mathematic lessons into five branches: numbers and operations, measurement, algebra, data analysis and probability.

The textbooks were analyzed for three intervals of developments (1970-1990; 1991-2005 and 2006-2013).

2.1 Content Analysis

This study followed protocols of Selltiz, Johada, Deutsch, and Cook (1986) for content analysis. The study was designed to answer the questions:

(1) How much mathematics existed through 1970-2013 textbooks?

(2) What kinds of mathematics were presented?

The basic unit of code applied in the current research is page. A total of 1,933 pages were analyzed which consisted of 657 different selection of lessons, divided into five topics; numbers, measurement, geometry, algebra, and data analysis and probability. The systematic manner of this study traces the number of mathematic lessons in the textbooks and the number of pages used for these lessons. The length of the lessons was also recorded to the nearest quarter of a page. A 43-year period expressed as mathematics percentage by total pages and by total lessons summarized the data. Qualitative content analysis was carried out to determine how mathematics was presented.

A variety of modes of transmission emerged in this study; these are reported but not quantified.

2.2 Selection of Student's Book

A distinctive selection of the representative textbooks during 1970-2013 was used in this content analysis. The students' books were selected to be the best representative of the textbooks of an era, because they were the most commonly used and imitated. Student's book writers used the same lessons because of poor regulation and enforcement in 1970.

For these reasons, this study used the students' books for the period 1970-2013.

It was only the first books that were analyzed in the case of students' books that came in graded series (First, Second and Third grade's). As such, that was the first children's exposure to mathematics, because they completed them, they were deemed well educated.

3. Results

3.1 Mathematics Quantity

Mathematics content is significant in the student's book for the period during 1970-2013. The amount of mathematics during these 43 years was 100% of the total page contents. The percentage of the lessons devoted to numbers was 87.25%.

At the beginning of 1970, mathematics book was only 112 pages. The quantity of pages of the student's mathematics book increased by the beginning of the 1987 (Figure 1), reaching up to 147 pages in the period of 1987 to 1993. The percentage of lessons of numbers in the student's book started at 83.33% and peaked in the 1987-1993 period at 87.33%.

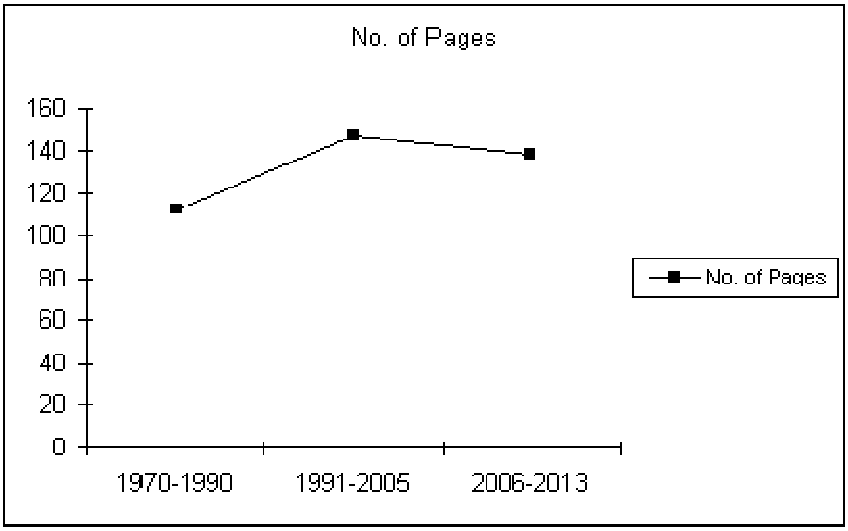

Figure 1. Number of Pages of Mathematics Textbooks

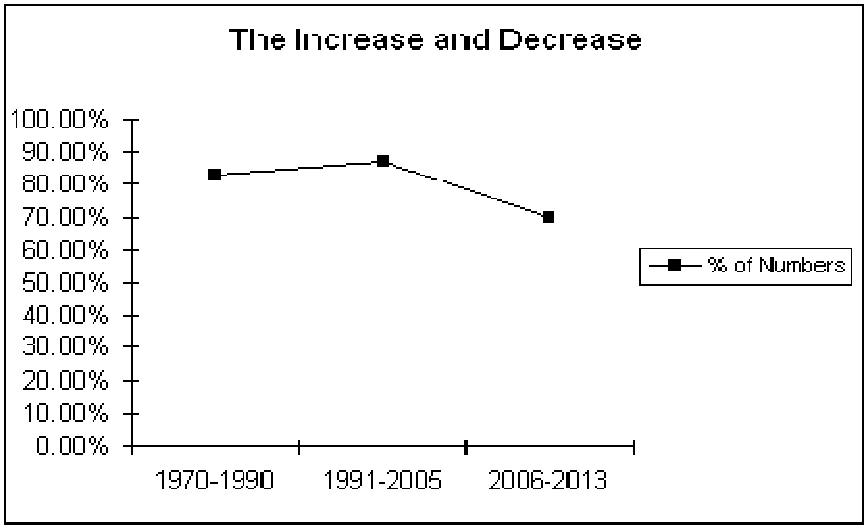

Figure 2. The Percentage of Numbers in The Textboos

The content of mathematics related to numbers fall constantly during 1970-2013 (Figure 2). This is interpreted because of rising of other topics in mathematic books. In 1970 textbook, numbers represented 83.33% of all of the mathematics lessons, however at the end of the year 2006; numbers represented 70.8% of the mathematics. For geometry, it increased during the 43 years from 6% to 17%. For measurement, it is started in 1970 at 8% and then increased to 15% in 1991 and closed at 19% in 2013.

3.2 Modes of Presentation

Presentation of mathematics in student's books took alternative forms. Sometimes it took place in a direct explanation of facts, which is common in mathematics textbooks of today. Recently, mathematics was also presented in an induction procedure. Efforts were sometimes made to involve mathematics with other types of subjects. The description of numbers would sometimes precede a story about science, literature, geometry or a data event. For instance, in second-year student's book a scientific information describing the importance of trees related to the facts of multiplication of number 3.

During the period (1970-1987), almost all of the lessons in student books were designed only for practice. On the one hand, poor usage of learning instruments, mistakes in printing, no activities, no practical situation and insufficient of periods are considered as the main characteristics of the textbooks. Nevertheless, there were no examples used to promote patriotism, hard work, honesty and social values. Later, after the year 1987, many improvements occurred in the textbooks in Jordan, but some problems remained, specially, those that are related to the teacher who follows the traditional way in introducing the lessons (Queen Rania Award (QRA), 2010).

4. Discussion

4.1 Rise in Mathematics Content

In 1993, the content of mathematics is increased in students' books. Many potential reasons helped to start this change, but it is quite difficult to establish causal relation in such kind of study. This growth, however, may reflect increase in the society in mathematics. The 20th century was a period of great scientific achievements, popularization of mathematics, and professionalization of mathematicians. Many famous names of mathematics were taken in consideration in mathematics textbooks, such as Al-Khwarizmi, Ibn al-haitham, Al-tousi, Omar Al-khayam and Al-karkhi.

Technological developments occurred at a rapid pace; all of which were due to the movement of educational development established at the year 1987. Mathematics became very popular; in the 1980s, widespread mathematics coverage emergence in newspapers, and numerous lyceum lectures in mathematics. Inclusion of mathematics in the student's textbooks might probably contribute in the popularity of mathematics.

4.2 Decline in Mathematics Content

The reduction of mathematics in students' books of the 1987 may have been a backlash against the large amount of mathematics being used there. The students' books were heavily laden with mathematics. For example, in third year student book there were only three topics: numbers with operations, measurement, and geometry. Establishment of mathematics is an integrated subject. One of the major factors participating in the reduction of the mathematics' quantity in student's books may refer to the aim of to establish mathematics as an integrated subject at school. In the end of 1989, teaching mathematicians was advocated as a separate subject in the elementary schools, to be adapted to the National Council of Teachers of Mathematics (NCTM) standards (NCTM, 1989).

4.3 Mathematics Content in Students' Books

4.3.1 Numbers and Operations

This study finds that numbers and its operations is the main type of mathematics during the period of 1970-1987. The rise in numbers could be attributed to authors influencing people to be interested in their beliefs about numbers used in life and the objectives of the teaching movement. Standards of living caused an increase in numbers content in the student books. Two educational movements resulted from the popularization of the natural world: object method of teaching and nature of mathematics study. Object method of teaching was very dominant in the years 1970 -1987 and is accepted as the primary of basic school mathematics. Objects that were interesting to children and readily available were used, along with the basic arithmetic operations such as addition, subtraction, multiplication and division, which fit into this category. A traditional method of object teaching influenced the action of computing. The number of lessons dealing with world aspects around increased because of object teaching. A large number of lessons in object teaching deals with the numbers in a traditional way based on training. Thus, the increase in numbers in student's books could be influenced by object teaching. The period from 1989-2013 was the peak of capitalized movement. This educational movement sought to empower a love of the nature of mathematics by direct students to observe the real world.

4.3.2 Geometry and Measurement

While computing numbers decreased, the geometry and measurement in students' books increased. This is because numbers became a more popular subject. Moreover, geometry increased in student books because of the

appearance of independent subjects such as; space geometry, analytical geometry and topology. The same manner applies for measurement; it was increased because of the new concepts such as mass, weight and capacity.

4.3.3 Other Topics (eg. Data Analysis and Probability, Agebra)

In spite of the success of the industrial revolution that depended on data, it is surprising that data analysis was not presented in a proper way in the students' books. Compilers of students' books may have neglected data analysis because it requires sufficient mathematical background which is more than what young students may have had. In addition, they can be less visual than either the numbers or geometry especially for the first three grades.

4.4 Mathematics in Modern Students' Books

Although changes have been made in systems of education and movements of instruction development, students' book still carries the same ideas. In new textbook, the topics that have been added are probability and data analysis for grade 3 in the year 2006. Nonetheless, data analysis was established for grades 1 & 2 as an application of problems of addition and subtraction only. Algebra did not appear as a separate unit in the textbooks, instead, it appeared as an open statement in addition to patterns in units related to numbers and geometry. The results of content analysis for the first three grades revealed that the type of mathematics in the expository selections of students' books is 92% of the mathematics selections were numbers and its operations, and it is 8% measurement for grade one in the year 1970. In 2013, the percentage of numbers and operations decreased to 75% and increased for measurement to 19%m and a new appearance for geometry was 6% as illustrated in Table 1.

Table 1. The percentage of content of mathematics for the first three grades

The class	1st grade		2nd grade		3rd grade	
The topic	1970	2013	1970	2013	1970	2013
Numbers and Operations	92%	75%	86%	78%	72%	65%
Measurements	8%	19%	6%	14%	11%	14%
Algebra	-	-	-	-	-	-
Geometry	-	6%	8%	8%	17%	11%
Probability and Data Analysis	-	-	-	-	-	10%

Moreover, the percentage of numbers and operations for grade 2 decreases to 78% while measurement increased to 14%, the percentage of numbers for grade 3 decreases to 65% while measurement increased to 14% and data analysis and probability was the first time to appear in these textbooks.

However, in modern student books, the amount of numbers has decreased, as selections of geometry and measurements have increased.

5. Conclusion

Analysis of Content of Jordanian students' books from 1970 till 2013 shows that it is not simply what the leaders of education thought should be taught, but what was actually taught (Alalem, 1994). An average of 147 pages was devoted to students' books at 1970, while 137 pages were devoted to students' books at 2013. The amount of mathematics peaked in the beginning of this century. While many factors involved gave the greater emphasis to technology. The influence of technology was a critical influence in pushing mathematics strongly in the student books. In 1991 students received significant mathematics education in their books because of a shift towards educational development, but still far from the standards of school mathematics NCTM (NCTM, 2000). Mathematics education is more than just something to learn, it could grow as a subject for students enabling them to investigate other materials. Yet still it is developed as a subject in a textbook.

In the 2006, the textbooks were developed to match NCTM standards of content for the three lower grades, but still there are some gaps in subtopics revealing that textbooks and school curricula do not place enough emphasis on the development of content standards.

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